



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/725,523	12/03/2003	Bing-Chang Wu	4425-338	3760

7590 03/18/2005

LOWE HAUPTMAN GILMAN & BERNER, LLP
Suite 310
1700 Diagonal Road
Alexandria, VA 22314

EXAMINER

SMOOT, STEPHEN W

ART UNIT PAPER NUMBER

2813

DATE MAILED: 03/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/725,523

Applicant(s)

WU, BING-CHANG

Examiner

Stephen W. Smoot

Art Unit

2813

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 December 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date. _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

This Office action is in response to application papers filed on 03 December 2003.

Specification

1. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: Method for Fabricating Silicide by Heating an Epitaxial Layer and a Metal Layer Formed Thereon.

Claim Objections

2. Claim 15 is objected to because of the following informality:
In claim 15, line 5, change "the sidewall" to --a sidewall-- for proper antecedence.
Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "the removal rate of said insulation surface" in line 7; and

Claim 1 recites the limitation "the removal rate of said epitaxial layer" in line 8.

There is insufficient antecedent basis for these limitations in claim 1.

Claims 2-14 are rejected under 35 U.S.C. 112, second paragraph, because they depend on claim 1.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1-10, 13-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Shishiguchi et al. (US 6,190,976 B1).

Referring to Figs. 2A-2F and column 5, line 20 to column 8, line 14, Shishiguchi et al. disclose a salicide method that includes the following features:

- A polysilicon gate electrode (4) is formed on a silicon substrate (1);
- Silicon dioxide spacers (5a, 5b) are formed on sidewalls of the gate electrode (4);
- Epitaxial silicon layers (8a, 8b, 8c) are grown on source/drain regions (6a, 6b) of the silicon substrate (1) and on the upper surface of the gate electrode (4);
- The source/drain regions (6a, 6b) are formed by doping with boron;
- The surface of the epitaxial silicon layers (8a, 8b, 8c) are thermally oxidized in order to oxidize residual silicon (18 in Fig. 2B) formed on the spacers (5a, 5b) resulting in oxidized layers (9a, 9b, 9c, 19) as shown in Fig. 2C;
- The silicon oxide layers (9a, 9b, 9c, 19) are then selectively removed by wet etching in diluted hydrofluoric acid, which also partially removes portions of the spacers (5a, 5b) as shown in Fig. 2D;
- A layer of titanium (10) is then blanket deposited over the epitaxial silicon layers (8a, 8b, 8c) as shown in Fig. 2E;
- The titanium layer (10) and the epitaxial silicon layers (8a, 8b, 8c) are then heat treated to form salicide layers (11a, 11b, 11c) as shown in Fig. 2F; and
- Cobalt can be used as an alternative refractory metal to titanium (also see column 10, lines 26-30).

These are all of the limitations set forth in claims 1-10, 13-16 of the applicant's invention.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. Claims 11-12, 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shishiguchi et al. (US 6,190,976 B1) as applied to claims 1, 15 above, and further in view of Zhang (US 6,440,762 B1).

As shown above, Shishiguchi et al. anticipate claims 1, 15 of the applicant's invention. However, Shishiguchi et al. do not teach or suggest etching silicon dioxide by dry etching, which is the further limitation to claim 1 set forth in claim 11 of the applicant's invention. More specifically, Shishiguchi et al. do not teach or suggest dry etching with a fluorine-containing compound, which is the further limitation to claim 11 set forth in claim 12 of the applicant's invention and also the further limitation to claim 15 set forth in claim 17 of the applicant's invention. Zhang suggests that carbon tetrafluoride can be used to selectively dry etch silicon oxide with respect silicon (see column 8, lines 9-31).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the salicide method of Shishiguchi et al. by substituting a carbon tetrafluoride-based dry etchant, as suggested by Zhang, for the diluted hydrofluoric wet etchant taught by Shishiguchi et al. Zhang recognizes that carbon tetrafluoride, as well as other fluorocarbons, are known in the art as suitable alternatives to dilute hydrofluoric acid that can be used to selectively etch silicon oxide with respect to silicon (see column 8, lines 18-19, 22-31).

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Furukawa et al., Kluth et al., Chen et al., and Vatus et al. teach salicide methods that feature the formation of a metal layer over an epitaxial layer.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 571-272-1698. The examiner can normally be reached on M-F (8:00 am to 4:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 2813

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SWS

Stephen W. Smoot
Patent Examiner
Art Unit 2813